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## New ferns described as hybrids in the genus *Dryopteris*

PHILIP DOWELL

During the past five years I have been interested in the study of our native ferns in the field; and in our woodland swamps on Staten Island, and elsewhere in the vicinity of New York, I have occasionally met with forms that are not referable to any one recognized species but have characteristics in common with two known species. I do not refer to sports or mutants, which I have found also, and which can usually be referred definitely to some one species. The most plausible explanation in the case of these ferns is that they are hybrids, or that they have at least originated as hybrids between the two species whose characteristics they share, and as such they are here described in accordance with our American code. At all events they are new and deserve to be described and named. It should be borne in mind that these ferns grow in moist woodlands or in swampy places, where the conditions are favorable for the mingling of the gametes, and that natural hybrids may thus be easily produced. This was mentioned in *Torrey* 6: 208, 1906, in an article entitled "Observations on the Occurrence of Boott's Fern," although at that time I was rather skeptical about hybrids among ferns. That hybrids do occur among ferns has been experimentally proved by Miss Margaret Slosson and others. By selecting and manipulating the prothallia with their antheridia and archegonia, Miss Slosson produced a hybrid between *Dryopteris cristata* and *D. marginalis* which looks the same as the natural hybrid described by G. E. Davenport as *D. cristata*  $\times$  *marginalis*. Miss Slosson produced also, in a similar manner, a hybrid resembling *Asplenium ebenoides* Scott. In his "Index Filicum" Carl Christensen recognizes a number of hybrids, of which he includes three or four in the genus *Dryopteris*, four if we include *D. pittefordensis*, of which he is not certain, but which is undoubtedly *D. marginalis*  $\times$  *spinulosa*, as suggested by Miss Slosson when she described it. The other three recognized in the Index Filicum are *D. Filix-mas*  $\times$  *spinulosa* (A. Br.) C. Chr., *D. cristata*  $\times$  *marginalis*

Dav., and *D. cristata* × *spinulosa* (Milde) C. Chr. The last has been considered by many botanists the same as our Boott's fern, but Christensen puts this as doubtful, and in my opinion they are not the same.

**DRYOPTERIS CRISTATA × SPINULOSA (Milde) C. Chr.**

*Aspidium cristatum* × *spinulosum* Milde, Nova Acta Acad. Leop.-Carol. **26**: 533. 1858.

*Dryopteris cristata* × *spinulosa* C. Chr. Index Filicum 259. 1905.

Of this fern I have collected specimens near Suffern, N. Y., 3927b, July 23, 1905, and 5273, October 6, 1907, Ocean Terrace, Staten Island, 3994a, August 2, 1905, and 5013, July 15, 1907; Bulls Head, Staten Island, 4380a, June 10, 1906, and 5053, July 24, 1907.

This differs from Boott's fern in having glabrous indusia, sori farther from the midvein, in being less deeply cut, having the stipes less chaffy, and the scales a paler brown.

**Dryopteris cristata × intermedia nom. nov.**

*Aspidium Boottii* Tuckerm. Hovey's Mag. **9**: 145. 1843.

*Aspidium spinulosum Boottii* D.C. Eaton in A. Gray, Man. ed. 5, 665. 1867.

*Dryopteris Boottii* Underw. Our Native Ferns, ed. 4, 117. 1893.

This occurs frequently in our woodland swamps.

The probability that this fern is a hybrid has been often stated and commented upon, and by many the opinion is held that it is a hybrid between *D. cristata* and *D. spinulosa*, as stated above. It differs from that fern in being more deeply cut, usually bipinnate, more chaffy at the base of the stipe, having the scales darker, the indusia and the under side of the blade glandular, and the sori nearer the midvein.

**Dryopteris Clintoniana × intermedia hyb. nov.**

Rhizome stout, chaffy: stipes 10–40 cm. long, densely chaffy at the base with thin light-brown scales, which have usually a darker center; blades ovate-lanceolate to oblong-lanceolate, 20–75 cm. long, 15–25 cm. wide, acuminate at the apex, slightly narrowed at the base, pinnate-pinnatifid to twice pinnate; pinnae oblong-lanceolate to triangular-lanceolate, acuminate, broadest at the base, the upper pinnatifid, the lower pinnate toward the base

in the fertile fronds; pinnulae 10–15 pairs, linear-oblong to oblong, acute or obtuse, somewhat falcate, serrate or the lower incised, the lobes spinulose-toothed with appressed teeth; sori nearer the midvein than the margin, indusia thin, reniform, glandular, not large.

In general appearance this fern resembles the Clinton fern more than the other, but it differs from that fern in the deeper cutting of its pinnae and in having glandular indusia, which are also smaller. It differs from *D. intermedia* in its more elongate shape, in the greater difference between its sterile and fertile fronds, in being less cut or divided, and in having the sori nearer the midvein. It resembles Boott's fern, *D. cristata*  $\times$  *intermedia*, more than it does any other. This is to be expected when we consider that they have one parent species in common and the other (*D. cristata* and *D. Clintoniana*) so closely allied that most botanists have heretofore placed one as a variety of the other. It differs from Boott's fern in being usually larger, wider in proportion to the length, being less deeply cut, having the pinnulae more falcate, the teeth more incurved or appressed, and the sori nearer the midvein. In the type locality and near Cornwall, Conn., vigorous plants of this fern were not rare. In the type locality I should call it fairly abundant, as abundant as Boott's fern, which grows in luxuriance in that locality. It was found associated with the alleged parent species in the following localities, except Bulls Head, where I have found only one plant of this fern and no plant of *D. Clintoniana*.

NEW JERSEY: Swamp above Lake Macopin, near Newfoundland, September 3, 1906, *Dowell* 4606, type; July 27, 1907, 5069.

NEW YORK: Suffern, July 23, 1905, *Dowell* 3928, October 6, 1907, 5269; Bulls Head, Staten Island, August 3, 1905, 3995; Richmond, August 17, 1905, 4049.

CONNECTICUT: Cornwall, July 4 and September 10, 1907, *R. C. Benedict* 72 and 267.

***Dryopteris Clintoniana*  $\times$  *Goldiana* nom. nov.**

*Dryopteris Goldieana celsa* Palmer, Proc. Biol. Soc. Wash. 13: 65. 1899.

Rhizome thick, chaffy: stipes 20–50 cm. long, densely chaffy at the base with thin light-brown scales having a darker center, or

with some thick dark-brown elongated scales ; blades pinnate pinnatifid, acuminate, the sterile triangular-ovate to ovate-lanceolate, 20–50 cm. long, 15–25 cm. wide, fertile blades ovate-lanceolate to oblong-lanceolate, narrowed at the base, 40–80 cm. long, 20–35 cm. wide ; pinnae deeply incised, sometimes divided at the base, ovate-lanceolate to oblong-lanceolate, acuminate, in some fronds the upper broadest at the base while the lower are narrowed at the base, in other fronds the lower broadest at the base while the middle and upper ones are broadest near the middle ; pinnulae or lobes of the pinnae 10–20 pairs, oblong to oblong-linear, obtuse or acutish, falcate, appressed-serrate or those of the lower pinnae slightly incised ; sori near the midvein, indusia thin, glabrous.

In general appearance this fern resembles the Clinton fern, with which it has been placed by some, while others have referred it to the Goldie fern. It differs from the former in having some of the thick dark-brown scales characteristic of the latter, and in having some of the pinnae narrowed at the base.

It differs from the Goldie fern in having fewer of the thick dark scales ; the fronds usually more narrow, more gradually tapering, and more narrowed at the base ; the basal pinnulae longest on a portion of the frond, the upper in some, the lower in others.

NEW YORK : Swamp near South Avenue, Staten Island, October 9, 1904, *Dowell 3558*, type ; low woods, Lower Genesee, near Rochester, *W. H. Lennon*, June 16, 1895.

NEW JERSEY : Springdale, near Newton, *Dowell 4929* and *5033*, July 4 and 22, 1907.

VERMONT : Swamp near Willoughby Lake House, August 21, 1896, "ex herb. *E. & C. E. Faxon*."

NORTH CAROLINA : Chapel Hill, September 1907, *W. C. Coker*.

VIRGINIA : Dismal Swamp, June 8, 1899, *William Palmer 247 i, j, and k*, labeled "*D. Goldieana celsa*, paratype." This last was reported as growing on logs, the others grew in the soil.

***Dryopteris Goldiana* × *intermedia* hyb. nov.**

Fronds 7.5–12 dm. long, about 3 dm. wide : stipes 25–40 cm. long, densely chaffy at the base with thick dark-brown linear-lanceolate scales and thin membranous scales, the latter extending on the rachis ; blades 50–75 cm. long, about 30 cm. wide, ovate

to oblong, bipinnate; pinnae oblong to oblong-lanceolate, mostly broadest toward the middle, the lowest unequally ovate-lanceolate, those near the middle of the blade most divided; pinnulae oblong or lanceolate, falcate, acute, large, incised, the lobes spinulose-toothed; sori slightly nearer the midvein than the margin, nearly terminal on the veinlets; indusia thin, glandular, not large, intermediate in cell-structure between those of *D. Goldiana* and *D. intermedia*.

In general appearance this fern looks like a large overgrown *D. intermedia*, but it differs from this in having the thick dark scales characteristic of *D. Goldiana* and the sori nearer the midvein. It differs from the Goldie fern in the cutting of the frond and in having glandular indusia, while it resembles this fern in its shape and size, in the shape of its pinnae and the falcate shape of the pinnulae, and in the character of its scales.

Type specimens are in the herbarium of the New York Botanical Garden, collected by Professor L. M. Underwood, August, 1899, near Jamesville, New York, in a locality abounding in *D. intermedia* and having occasional patches of *D. Goldiana*.

***Dryopteris Goldiana* × *marginalis* hyb. nov.**

Rhizome short, thick, densely chaffy; fronds erect or ascending, 5–11 dm. tall; stipe 20–35 cm. long, densely chaffy at the base with thick dark-brown linear-lanceolate scales mixed with thin membranous scales, the latter extending on the rachis; blade bipinnate, abruptly acuminate, the sterile triangular-ovate to ovate-lanceolate, 15–50 cm. long, 10–20 cm. wide, pinnate-pinnatifid; the fertile ovate-lanceolate to oblong-lanceolate, 30–75 cm. long, 20–35 cm. wide, bipinnate; pinnae ovate-lanceolate to oblong-lanceolate, long-acuminate, broadest toward the middle; pinnulae oblong to oblong-linear, falcate, acute or obtuse, serrate or incised, decurrent on the rachis, those on the lower side of the basal pinnae sometimes conspicuously elongated; sori about midway between the margin and the midvein, or nearer the margin, indusia firm, glabrous, not large.

In general appearance, as well as in detailed characteristics, this fern is intermediate between its alleged parents. Large fronds suggest *D. Goldiana* in appearance while the smaller look like *D. marginalis*, but all the specimens and the several plants examined showed scales characteristic of both species, their sori are intermediate in position, and the indusia intermediate in character. Its

relationship to the Goldie fern is established by the presence of the unmistakable dark elongated scales, while its relationship to the marginal fern is shown by the character of the indusium and the shape and color of the frond, — the characteristic dark bluish-green upper surface and the glaucous appearance of the under side. It differs from the latter by its larger size, by its thick dark-brown scales, and by the position of the sori away from the margin. It differs from the Goldie fern in having the fertile fronds bipinnate, in the greater difference in color between the two surfaces of the frond, in having thicker indusia and the sori midway between the midvein and margin.

About a score or more plants of this fern were found along the edge of a large swamp west of Springdale, near Newton, New Jersey, on July 4, 1907, *Dowell 4931*, type. On July 22 another plant (*no. 5035*) of this fern was found in a different part of the swamp. The marginal fern is common and the Goldie fern is occasional along the edge of the swamp.

Most of the specimens cited above are in the herbarium of the New York Botanical Garden.

In conclusion I may add that this paper is not intended primarily as a contention or a defense for the theory of hybridity. The principal points on which I base my opinion that these ferns are hybrids, may be summed up briefly as follows: Each fern has characteristics common to two species and cannot be referred to any one previously described species alone, except in the case of Boott's fern, which has been described as a species; they have a tendency to be sterile, the sporangia being largely abortive; they occur only occasionally, and rarely in large numbers in any one locality; they grow in places favorable for the mingling of the gametes; they are found usually associated with the supposed parent species; hybrids among ferns have been experimentally produced, and are known to exist.

PORT RICHMOND, N. Y.